

# PATENT SPECIFICATION

996,385

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## COMPLETE SPECIFICATION

### DRAWINGS ATTACHED

#### Improvement in the Production of Pneumatic Tyres

We, AVON RUBBER COMPANY LIMITED, formerly THE AVON INDIA RUBBER COMPANY LIMITED, of Melksham, Wiltshire, a British Company, do hereby declare the invention, 5 for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to improvements in 10 pneumatic tyres and their production.

In recent years a type of tyre construction has been developed, which consists essentially of a carcass of textile or metallic cords, which are disposed at zero, or at a small 15 angle to the radial planes containing the axis of the tyre and which contains in the crown area between the carcass and the tread, a number of re-inforcing layers of rubberised textile or metallic cords. Tyres of this construction will be referred to in this specification as radial cord tyres. The re-inforcing layers are effectively circumferentially inextensible and are able to resist lateral deformations. When correctly constructed, a tyre 20 of this configuration will have amongst other properties, the ability to resist wear.

For the maximum economic advantage, few layers of cords (known alternatively as, plies) are used for the carcass in radial cord 25 tyres and the preferred arrangement is to use a single layer or ply of metallic cords. Particularly with a single layer, we have found that it is necessary that the cords maintain a constant spacing, since any gap 30 in the cords will lead to a substantial weakness at that particular part of the completed tyre.

One method of building radial cord tyres includes two stages as follows. In the first 35 stage the carcass ply and a number of other components including the bead wires are assembled on a cylindrical drum. In the second stage this assembly is removed from

the drum and is expanded, so that the centre portion of the carcass attains the correct 45 circumference for application of the crown re-inforcing layers. This circumference will be substantially the same as that in the final vulcanised tyre. In the second stage there is a tendency for the cords of the carcass ply 50 to assume irregular spacings.

An object of the present invention is to provide an improved method of constructing a radial cord tyre wherein the carcass, when expanded, attains uniform circular shape and the spacing between the cords composing the carcass is kept as regular as possible. 55

According to the invention we provide a method for the manufacture of a radial cord tyre as herein defined which includes the steps of laying on a cylindrical tyre building drum to surround the drum a layer of vulcanised or partially vulcanised rubber and laying one or more plies to form a carcass on top of said layer so that the layer forms 60 a liner for the carcass which assists, during expansion of the carcass prior to application of crown reinforcing layers, in maintaining a uniform or substantially uniform spacing of the cords of the carcass ply or plies. The layer may be formed into a cylindrical band prior to the laying of the carcass ply or plies on top of the layer. The cylindrical band 65 may be formed with one or more joins which are made at an angle to the axial direction 70 of the drum.

In order that the invention may be clearly understood and readily carried into effect, one form thereof is described with reference to the drawing accompanying the Provisional 80 Specification wherein the production of a pneumatic tyre is illustrated diagrammatically in sequential stages:—

Figure 1 shows in section a tyre building drum upon which has been placed a band 85 of vulcanised or partially vulcanised rubber.

[Price 4s. 6d.]

Price 3s.

Figure 2 is a similar view to Figure 1, with the addition of a carcass ply.

Figure 3 illustrates the stage where the tyre bands and rubber chafers have been 5 added and the edges of the carcass ply turned up as usual.

Figure 4 shows the carcass of Figure 3 after removal from the tyre building drum, expanded ready for application of the crown-10 re-inforcing layers, and tread and

Figure 5 shows in cross-section a completed tyre.

Normally the carcass of a radial cord tyre is built up on a cylindrical tyre building 15 drum from a flat strip or flat strips of parallel textile or metal cords embedded in uncured rubber and in the first stage of the building, the strip or strips have to be joined to form one or more concentric cylindrical 20 layers or plies with the cords running at 90° or nearly 90° to the circumference of the drum. When the carcass is expanded circumferentially after the first stage of building, the presence of the join or joins and of any 25 irregularity in the components will cause uneven expansion. This particularly applies in the case where the carcass is made of a single ply of metallic cords and where the only continuity in the circumferential 30 direction is provided by uncured rubber in which the cords are embedded. At a weak spot, there will be relatively more extension of the uncured rubber, resulting in a reduction in thickness at that spot and there will be 35 even less resistance to expansion. The effect is to accentuate irregular spacing of the cords, cause opening of the join or joins, and the shape of the carcass in the expanded state will not be truly circular. However, if 40 according to the invention, a vulcanised or partially vulcanised rubber layer *a* is applied to the drum *b* so as to underlie the carcass *d*, this will control the shaping. Such a layer may extend from the toe of one bead to the 45 toe of the other bead as shown in the drawing or it may be wider and extend from the heel of one bead to the heel of the other. Vulcanised or partially vulcanised rubber will not thin locally on expansion as its 50 resistance to extension increases with expansion. A thin layer of a low modulus rubber is found to be sufficient. In the preferred form the thickness varies between 0.015" and 0.050" and the tensile modulus varies be- 55 tween 500 and 1500 lbs. p.s.i. at 300% extension. In the especially preferred form the thickness of this layer is 0.020" and the tensile modulus 1100 lbs. p.s.i. at 30% extension.

60 A particular advantage which follows from the control provided by the vulcanised rubber layer *a* is that a cylindrical drum *b* of a diameter less than that of the bead wires *c* can be used to build the carcass. The 65 method of building the carcass using such

a drum simplifies the construction of the tyre insofar as turning the carcass *d* around the bead wires *c* and bead filler *e* is facilitated. The use of such a drum has hitherto been limited, due to the fact that with a small 70 diameter drum, the ratio of the circumference of the carcass at building to that at the stage for applying the crown re-inforcing layers is large and it is, in general, not possible to maintain a uniform stretch in the 75 carcass through such an extension. The invention obviates this difficulty.

The layer of vulcanised or partially vulcanised rubber is preferably joined into a cylindrical band, prior to assembly of the 80 carcass. The join in the band is preferably as narrow as possible and may be at an angle to the axial direction of the drum so that it does not substantially influence the 85 circumferential stretch of the band in the shaping operation. With the join made in this way, a regular spacing of the cords is ensured.

The influence of the band *a* is most important in the crown area of the tyre so that 90 a similar effect to a layer extended from one bead portion to the other bead portion may be obtained with a narrower layer formed into a band confined to the crown area only. Alternatively, a number of parallel contiguous bands may be disposed circumferentially round the inside of the carcass together 95 covering at least one third of the area of the inside surface of the tyre.

In the preferred method of building, a 100 layer of vulcanised or partially vulcanised rubber is formed into a band of circumference of 2% to 5% less than the circumference of the building drum. The band *a* is normally applied to the building drum *b* 105 by first being rolled up on itself axially to form a ring and then stretched over the drum and unrolled. The exposed surface of the layer of rubber is then prepared so that it is tacky. The carcass ply *d* is applied without stretch to the building drum to overlap the band *a*. This method ensures that the carcass ply adheres firmly to the band *a* and avoids difficulties often encountered due to the carcass ply stretching under its own 110 weight and looping at the base of the building drum. It will be appreciated that the method of the invention may be applied to the building of a tyre wherein there are a number of 115 carcass plies instead of the one ply described 120 with reference to the drawing. The plies are formed of rubberised parallel metallic or textile cords.

The vulcanised or partially vulcanised 125 layer is conveniently composed of rubber which has enhanced resistance to ozone attack. This is necessary because rubber under stress caused by static extension is more susceptible to ozone attack than unstretched rubber and when the 130

carcass is expanded from the first stage of building to the second stage of building as shown in Figure 4, a stretch in the circumferential direction of up to 120% is encountered in the crown area of the carcass. As the layer of rubber is vulcanised or partially vulcanised, the stress caused by this extension will not totally disappear during the final vulcanisation of the whole tyre with 10 crown re-inforcing layers and tread as shown in Figure 5, thus making desirable the use of rubber having enhanced resistance to ozone attack.

**WHAT WE CLAIM IS:—**

15. 1. A method for the manufacture of a radial cord tyre as herein defined which includes the steps of laying on a cylindrical tyre building drum to surround the drum a layer of vulcanised or partially vulcanised 20 rubber and laying one or more plies to form a carcass on top of said layer so that the layer forms a liner for the carcass which assists, during expansion of the carcass prior to the application of crown reinforcing 25 layers, in maintaining a uniform or substantially uniform spacing of the cords of the carcass ply or plies.

2. A method as claimed in Claim 1 wherein the layer is of low modulus rubber 30 and has a thickness of between 0.015" and 0.050" and a tensile modulus of between 500 and 1500 lbs. p.s.i. at 300% extension.

3. A method as claimed in Claim 1 or 35 Claim 2 wherein the layer is formed into a cylindrical band prior to the laying of the carcass ply or plies on top of the layer.

4. A method as claimed in Claim 3 wherein the cylindrical band is formed with one or more joins which are made at an 40 angle to the axial direction of the drum.

5. A method according to Claim 3 or Claim 4 wherein the layer is formed into a band of a circumference of 2% to 5% less

than the circumference of the tyre building drum.

6. A method according to any one of Claims 3 to 5 wherein the band is applied to the building drum by first being rolled up on itself axially to form a ring and then being stretched over the drum and unrolled.

7. A method according to Claim 1 or Claim 2 wherein the layer on the drum prior to the application of the carcass ply or plies is in the form of a number of parallel contiguous cylindrical bands, the layer covering at least one third of the inside area of the resulting tyre.

8. A method as claimed in any one of the preceding claims wherein the layer on the tyre building drum extends from the toe or heel of one bead to the toe or heel respectively of the other bead of the superimposed carcass.

9. A method as claimed in any one of claims 1-7 wherein the layer on the tyre building drum is confined to the crown area of the superimposed carcass.

10. A method according to any one of the preceding claims wherein after the layer has been applied to the drum, the exposed 70 surface of the layer is made tacky and the carcass or plies are then laid on top of it without stretch.

11. A method for the manufacture of a radial cord tyre as herein defined substantially as herein described with reference to the drawing accompanying the provisional specification.

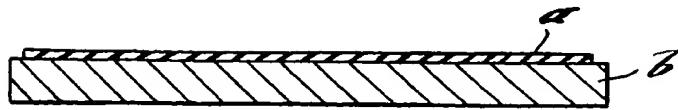
12. A pneumatic tyre manufactured by a method claimed in any one of the preceding claims.

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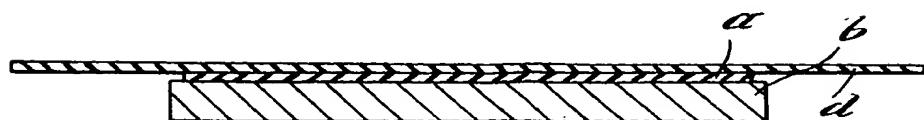
996,385 PROVISIONAL SPECIFICATION

1 SHEET

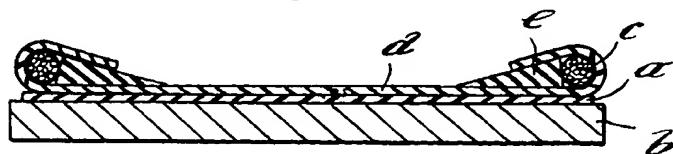
*This drawing is a reproduction of  
the Original on a reduced scale.*



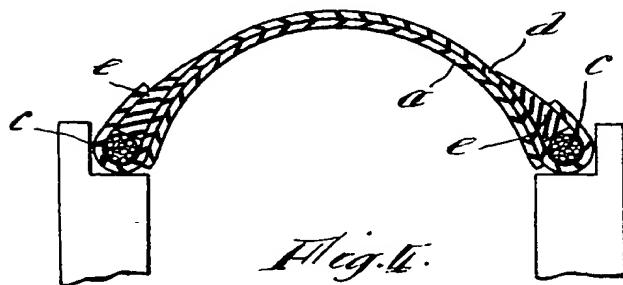
*Fig. 1.*



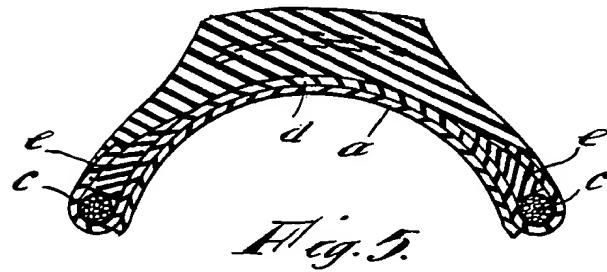
*Fig. 2.*



*Fig. 3.*



*Fig. 4.*



*Fig. 5.*